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Enhanced Tools to Improve Situational Awareness

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Enhanced Tools to Improve Situational Awareness

A Study prepared for

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by

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Enhanced Tools for Situational Awareness

Executive summary

Commonly shared situational awareness is essential to the success of almost any team endeavor. Many information networks and processes in the military environment are specifically designed to collect, filter, package, and provide information. The mismanagement of time critical knowledge can result in delays in response and confusion when information regarding changes in the operational environment is not rapidly delivered to the right audience. This analysis provides recommendations for consideration of readily available information awareness tools to enhance this process.

Our survey of information systems in present use reveals some non-desirable attributes and illuminates new concerns created as the result of the second order consequences of employing more complex and powerful systems. Some of these areas of concern include:

- Increased exclusiveness of information to a narrow user community
- Greater difficulty to alert a large group of forces to new and developing vital information in a rapidly changing dynamic situation
- Difficulty to alert and inform a large segment of the forces to a changing environment in a slowly developing situation
- Intermittently connected users lack a simple utility to become quickly updated with the latest information status
- Inability to provide information across architecture domains or security enclaves
- Inability to export and extend the information network to newly arriving participants

An analysis of the major fielded situational awareness systems including the Common Operational Picture (COP), Global Command and Control System-Maritime (GCCS-M), Collaboration at Sea (CAS) was conducted. Included also were Microsoft Chat and Really Simple Syndication (RSS) as candidate solutions. Each system or tool was first screened to identify those possessing the desired characteristics of a potential solution. Then the qualifying systems were screened using a matrix of weighted factors. The assigned weighting factors were determined based on discussion with Subject Matter Experts provided by the client.

RSS emerged as an affordable candidate satisfying most of the attributes of the desired solution. RSS provides a "Severe Weather Alert" service to a netted environment of information systems lacking this common cross domain capability.

We conclude and recommend that RSS be further trialed and evaluated under exercise or controlled conditions to assess its potential usefulness as a "bell ringer" to enhance the group focus on significant and important situational developments.

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1. Introduction

Commonly shared situational awareness has long been regarded as essential to the ultimate success of almost any team endeavor. Many information networks and processes exist in the military environment that are specifically designed to collect, filter, package, and provide information, often as an archive, intending to enhance situational awareness. Substantial investments have been made in information fusion and display systems that are dedicated to increasing the speed of tactical maneuvers. These systems, for the most part, serve their client communities well but can add to isolation of shared awareness due to their unique hardware requirements, specialized operational architecture domains, operator and user workload overhead, or security enclave. Too often mismanagement of time critical knowledge, essential to rapidly focus attention of planners and responders, results in time delays in response and confusion when information regarding changes in the operational environment is not rapidly delivered to the right audience. The ability to provide this knowledge to the targeted audience at the right time without additional infrastructure to generate, transmit/display, receive and ultimately interpret, then act upon by the target audience is valuable. This analysis will provide recommendations for consideration of presently available information awareness tools.

2. Project Objectives

The objectives of this project are to:

1. Analyze the present information delivery tools and prepare a gap analysis with respect to relevance, timeliness, and responsiveness as relevant factors.
2. Research solutions for providing near real-time, pertinent information to the fleet.
3. Provide analysis and conclusions identifying preferred solutions.
4. Propose an implementation plan for preferred solutions.

3. Background

Military organizations, composite warfare groups, or platform-specific enterprises, are viewed as hierarchical structures embodying the refined characteristics of a centralized and lean operation, yet operate in a complex but dynamic and uncertain environment. The processes that provide agility and partially resolve the dichotomy between structure and desired behavior is the fusion of information. Significant investment in information fusion technologies has produced an entire array of systems capable of providing and

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disseminating information in such forms as the 'Common Operational Picture' (sometimes with the added clarifier 'Relevant').

Many architectures have been developed with a specific user community focus adding to exclusiveness of the information to that community and normally benefiting only those participants who are actively engaged in that information system. Additionally, the increased use of collaborative planning and execution tools, and proliferation of displays of unassociated information, more frequently leaves the end user tasked with searching through a variety of displays and web sites to find what suits their needs while assuming, often times an implicit yet unrealized assumption, the risk that vital information will be remain unrecognized. More simply stated: *"If I only knew what was going on earlier, I could have responded sooner."* Also, pull-information gathering processes results in familiar *"you don't know what you don't know"* limitations.

Sources of information commonly used by naval forces include those depicted in Figure 1. The problem addressed is not the lack of information available, but how rapidly attention can be focused on a developing situation amongst the clutter.

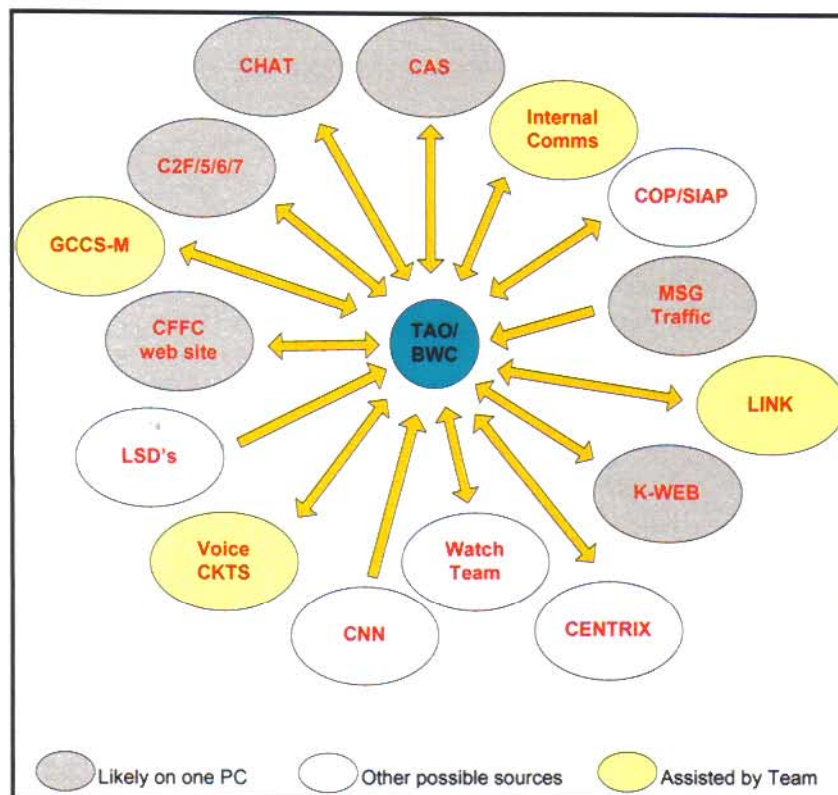


Figure 1. The Information Clutter

A large quantity of information sources is available. By doctrine or preference, any particular operator's attention is dedicated to different information displays, or, during

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periods of light activity, the participant's attention is likely not actively focused on any of the available information displays. A gap in the array of situational awareness sharing tools we have identified is the ability to simultaneously alert and inform a large segment of the forces of either a rapidly, or sometimes more importantly a slowly, developing or changing status of the operational environment. In a sense, this is similar to the need for a "Severe Weather Alert" broadcasted across several networks. This gap inhibits the ability to rapidly transition from Phase Zero operations to full combat engagement.

While gaps may exist in the capabilities of fielded data fusion and display systems employed at the tactical level of operations today, the process void examined by this study focused on initial alerting of an event requiring a rapid transition to employ the tactical operational systems. In essence, get all the linebackers turned around to face the same side of the field. It was not intended to *fight with the tool* but become aware *with the tool* that *there is a battle to fight*.

In a like manner, the intermittently connected user, a submarine for example, is faced with becoming appraised of the most urgent or most significant changes in the operational environment upon connection to the group following a period of absence. The use of "Submarine Force Summaries" accomplishes this task today but requires the services of a dedicated staff that relies on their own access to all available information services; to choose and filter those items of relevance to the submarine asset; and then create, maintain, and post an updated product for the submarine's consumption. This is a time-consuming, labor-intensive, and often inadequately completed task. Additionally there may be gaps in information created by the lack of awareness of in-situ developments perceived as unimportant. A means to allow a rapid update of the latest status with an ability to pull only those historical items of relevance would simplify and enhance this process.

In non-traditional situations such as responses to GWOT, Maritime Interdiction Operations, Disaster Relief, or Joint Agency Task Force (JATF) Operation, which are conducted utilizing doctrinally established military operations protocols, it is not apparent that an effective cross-domain, information-sharing tool exists. The attributes for a desired tool would be one that is not hardware specific, easily exportable to those joining the effort (preferred to be as simple as downloading a ".zip file" and executing the tool), and involves intuitive user characteristics that do not require specialized training.

For coalition operations, or those involving non-defense supporting or supported agencies, a tool that can be hosted on networks of different security enclaves is necessary. To further elaborate, the content would need to be maintained at the category of the network with the lowest security level, but the content can be readily exported to higher security level enclave hosts.

Within this very broad domain, the remainder of this discussion will hone in on a fairly specific and narrow context in order to allow a more focused analysis and pointedly targeted recommendation.

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4. Scope

This study encompasses the naval domain of information conduits. Due to time constraints the study captured readily available common tools that could be used for a demonstration of process but was not exhaustive across all technological solutions.

There are likely more suitable tools whose attributes provide better fit to the gaps identified in this analysis. Our goal is to explore a process improvement using at least one acceptable solution for illustration. Further analysis is recommended to fully explore all alternatives before investing in a final solution for implementation.

5. Methodology

The consultant team conducted group interviews and discovery discussion with subject matter experts to understand presently deployed information systems and capabilities under near-term development. The team reviewed TTP (Tactics, Techniques, and Procedures) practices and explored in-depth gap deficiencies and situational awareness challenges.

Applying business process redesign principles, the team conducted multiple alternative screens and qualification filter analyses of open source tools to isolate optimum solutions. A recommended solution was selected for live practical demonstration.

6. Results

Satisfying all the attributes discussed above of the qualities for the ideal situational awareness alerting tool represented a tall order to fill. In order to systematically analyze the ability of presently fielded and potential future candidates to satisfy these attributes, a first-level screen was conducted. The major fielded situational awareness systems include the Common Operational Picture (COP), Global Command and Control System-Maritime (GCCS-M), and Collaboration at Sea (CAS). A concept termed "K-Web," or Knowledge-web, has been employed by some strike groups. We considered the K-Web attributes to be very similar to CAS and did not consider a separate screen for K-Web was warranted. Microsoft Chat is a collaboration tool in common fleet use. RSS or "Really Simple Syndication" is a candidate solution added to the analysis. Appendix A provides a summary of characteristics of RSS and MS-Chat. Figure 2 summarizes the results of this first-level screen.

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First- Level Screen

	COP	GCCS-M	RSS	CAS	MS Chat
Situational Awareness	N	Y/N	Y	N	Y
Customer Satisfaction	Y	N	Y	N	Y
Performance	Y	Y	Y	Y	Y
Flexibility	N	N	Y	Y	Y
Process Integration	N	N	Y	N	Y/N
Persistence	Y	Y	Y	Y	N
Reduced Operator Interaction	N	N	Y	N	N
Coalition/OGA	N	N	Y	N	N
Extensible & Exportable	N	N	Y	N	Y
	3	2.5	9	3	5.5

Figure 2. First-Level Screen

The first-level screen revealed that RSS, MS-Chat, CAS, and COP had qualities that address the characteristics sought for to satisfy the identified gap. COP scored equally with CAS during this first-level screen, however, because of its present narrow mission focus, COP was not considered a potential solution candidate. A detailed description of the first-level screen attributes and the rationale supporting the scoring decision process is contained in Appendix B.

Next, weighting factors were assigned to the desired attributes and each attribute scored based on the degree of the system's ability to satisfy that requirement. Generally, an attribute valued as satisfying the quality during the first-level screen was scored in the range 5 or greater. If the attribute was not considered satisfied during the first-level screen, the filter score was in the range of 5 or less. Figure 3 contains the results of this filter analysis.

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FILTER 2

		RSS		CAS		MS Chat	
	Weight	Team Score	Total	Team Score	Total	Team Score	Total
Situational Awareness	10	10	100	4	40	9	90
Customer Satisfaction	10	10	100	3	30	8	80
Performance	8	9	72	6	48	9	72
Flexibility	7	10	70	7	49	5	35
Process Integration	9	9	81	3	27	6	54
Content Control	9	10	90	10	90	6	54
Bandwidth	6	10	60	3	18	5	30
Persistence	8	9	72	9	72	5	40
Reduced Operator Interaction	7	8	56	3	21	4	28
Total			701		395		483

Figure 3. Weighted Attribute Filter

The weighting factor and the team score were multiplied then the totals for each candidate tool summed to achieve a composite score. Appendix C contains further discussion of this analysis.

7. Conclusions

For the utility sought in a tool that can satisfy most of the attributes desired, RSS provides an affordable candidate that can be further trialed and evaluated in exercise or controlled conditions. In an exercise setting, meaningful metrics can be monitored to aid in evaluation of the system's performance to achieve the desired results. Careful consideration will need to be exercised to develop employment guidelines that ensure the real benefits of RSS are maintained. RSS in this application is intended to be the bell ringer of significant change in the operational environment. We caution that the over use of RSS for non-critical content may diminish its potential effectiveness as a situational awareness enhancing tool.

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8. Recommendations

As summarized in Figure 4 below, RSS is recommended as an application tool to satisfy the need to provide a pushed system of timely, relevant, and most cost effective information sharing solution. The technology is mature and stable, having been in commercial service for several years. Content is controlled at the origin and manpower overhead is envisioned to utilize existing resources. The application is flexible and adaptable to multiple situations and communities. The end-user customer's actions are optimized to require only reading and acting on the content as it is provided to the displays.

Recommended RSS Solution

- Relevant, perishable, situation awareness information is pushed by the Commander through the watchfloor to customer community.
- Improved performance enabled by better information.
- Tactically agile to changing environments.
- A very minimal investment with potential for significant cost aversion and enhanced operational performance.

Figure 4. Recommendation Summary

All in all, RSS provides significant potential to enhanced orderly information delivery in an already overly complicated communications intense environment.

We recommend that RSS be hosted in a synthetic training or modeling and simulation environment setting to further evaluate its potential utility. A user group for RSS should be formed to develop employment guidelines. During exercise scenarios, metrics for group responsiveness to changing operational environments should be collected and analyzed to isolate the factors of increased responsiveness that RSS is proposed to provide. Once familiarity with RSS employment is attained, refine a roll-out strategy for RSS introduction to into the fleet.

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Real Consultants - Real Results, Ltd. stands by to provide all levels of assistance to implement the above recommendations.

Appendix A

Supporting Data

RSS - The acronym RSS stands variously for the following standards: Really Simple Syndication, Rich Site Summary, and RDF (Resource Description Framework) Site Summary with Really Simple Syndication coming in as the latest iteration. Really Simple Syndication is a tool used for gleaning relevant information from the Internet¹ and has become the standard data format for communicating news, updates or any other type of information that needs to be syndicated to a large audience. Further, RSS technology can be used to enhance research methods for students or to glean current information from on-line journals, publications, web logs and other sources such as on-line news sites without having to visit the sites daily.² If you've never heard of RSS, then you are not alone. A recent Pew Internet & American Life Project shows that only 9% of Americans understand what RSS feeds do, and according to Forrester Research, only 2% of households with Internet access use RSS.³ RSS solves any number of problems that webmasters regularly face, such as increasing data traffic, and gathering and distributing news.

RSS is actually part of a larger family of data delivery formats that allow the delivery of regularly changing data content such as web logs (blogs), news feeds, or podcasts. Many people who regularly use the web as a news source do so by surfing numerous news sites and browsing through the leading articles. This can be problematic in that it takes some time to regularly access each site and then peruse the articles in order to find those that are worth additional time. RSS allows you to easily stay informed by retrieving summaries of the latest content from the sites you visit most often. An added benefit is that the RSS user doesn't have to sign up with the site in order to receive RSS content, which provides an extra measure of personal security. Users of RSS content use programs called feed readers or aggregators. The user subscribes to a feed by supplying to their reader a link to the feed; the reader is then able to check the user's desired feeds to see if any of those feeds have any updates since the last time it checked, and, if so, retrieve that content for presentation to the user. RSS represents a real-time, dynamic delivery of user specified news updates. In the context of our research, RSS represents the most formal information delivery medium. Content is developed and delivered from specific sites and content control is exercised by a few administrators that have exclusive access to that content.

Publishing an RSS feed is just the beginning. RSS, essentially a mini database containing headlines, is a primed for layering on additional services. RSS data can be published to PDA's cell phones, or as e-mail ticklers. The centerpiece of any RSS data feed is the

¹ Web Site:

<http://portal.acm.org/citation.cfm?id=1113379&coll=portal&dl=ACM&CFID=27565439&CFTOKEN=64935696>

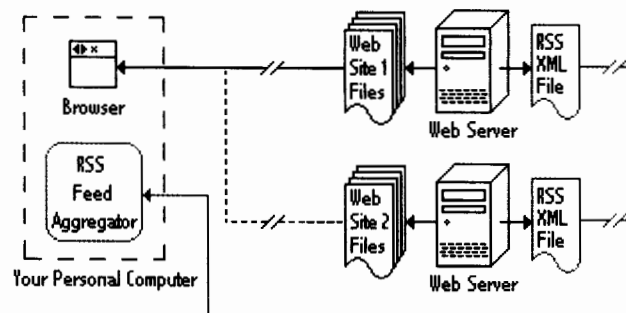
² Ibid.

³ Overholt, Learning to Love RSS. Fast Company, 99 (October, 2005), pg 43.

aggregator. The aggregator is a client software application or Web application that aggregates syndicated web content such as news headlines in a single location for easy viewing. “Aggregators reduce the time and effort needed to regularly check websites for updates, creating a unique information space or “personal newspaper.” Once subscribed to a feed, an aggregator is able to check for new content at user-determined intervals and retrieve the update.” One of the biggest concerns that Navy users, especially those aboard a ship or submarine, will have is that of the bandwidth required to run and update the feeds. And while RSS is, from a data perspective, asymmetrical in nature, users do request updates from the RSS server. To maintain the feed requires little to no bandwidth. However, supporting regular surges of simultaneous connections from users could require some thought. The problem is not foreign and there are solutions available. RSS in the manner that we are speaking doesn’t need to be hosted from a public network. The service could be provided either from within NIPRNET, understood here as not secure, or even on SIPRNET. RSS is simply a service that could ride on any network chosen. Finally, RSS is truly an emerging technology vs. Chat Services which, if one reads anything from the fact that Microsoft is no longer hosting chat rooms, is mature, even, aged a bit.

“Tying it all together”

The diagram below illustrates the Web sites, the RSS feed XML files, and personal computer connections.



The diagram shows a Web browser being used to read first Web Site 1 over the Internet and then Web Site 2. It also shows the RSS feed XML files for both Web sites being monitored simultaneously by an RSS Feed Aggregator.”⁴

Chat Services (MSN Chat for example) - Chat is a text-based real-time program that allows users to communicate with each other through an Internet connection. According to AVC online, typical users will connect to a chat server using a chat client and meet in a chat room. Once the users are in the same chat room, they can converse with one another by typing messages into a window where all of the other users in the chat room can see the message. The user can also see all of the messages entered

⁴ Web site: http://whatis.techtarget.com/definition/0,289893,sid9_gci1088619,00.html

by the other users. Conversations are then carried on by reading the messages entered by the other users in the chat room and responding to them. The technologies that allow users to converse in real time via typed messages are the chat servers and the chat clients. These special servers allow the messages to be quickly received and posted so that the chat clients can receive the messages and display them in the window on the users' computers. If RSS represents a formalized data delivery method and Wiki represents informal, then chat services can be chaotic if a policing agent does not exist. A dedicated chat room requires significantly more bandwidth than does RSS. Chat requires a certain amount of overhead bandwidth just to maintain connections "into the chat room" open. This could represent an amount that is unacceptable to those platforms that have limited connectivity to begin with. Should a flurry of action begin, then chat, given its duplex channel nature, will use increasingly larger amounts of any network bandwidth available. Considering that much of that network bandwidth may be limited because of connectivity on and off the platform, this could reduce the amount of bandwidth available to other critical communications channels. Much like RSS, Chat, in the sense of shipboard information awareness, can be hosted from servers behind either the NIPRNET, or SIPRNET, and hence, demonstrates the same security posture as would be found with RSS.

Wiki – Wiki was not introduced as a useful solution towards improving situational awareness in this domain, due to its mention and comparisons it is briefly described. Unlike the more formal RSS, wiki tends towards informal in methodology. And while Wiki provides data content just as RSS does, Wiki sites require proactive user interaction in order to get that data. Further, Wiki sites and the data contained there, can be accessed, edited, and/or deleted by anyone at anytime. This is where the Wiki community comes in. Wiki communities allow users to access the site and add, edit or delete content. Literally millions of people have visited Wikipedia, for example, and have made it a first stop research tool. How is content managed on this site, though? Among the four types of users are a few with administrator privileges. It is these administrators that ensure that Wiki content is maintained as accurate and rated "G."

Appendix B

First- Level Screen

First- Level Screen

	COP	GCCS-M	RSS	CAS	MS Chat
Situational Awareness	N	Y/N	Y	N	Y
Customer Satisfaction	Y	N	Y	N	Y
Performance	Y	Y	Y	Y	Y
Flexibility	N	N	Y	Y	Y
Process Integration	N	N	Y	N	Y/N
Persistence	Y	Y	Y	Y	N
Reduced Operator Interaction	N	N	Y	N	N
Coalition/OGA	N	N	Y	N	N
Extensible & Exportable	N	N	Y	N	Y
	3	2.5	9	3	5.5

Defined Criteria

Situational Awareness: The ability to provide pertinent information to the necessary users in a timely manner.

- COP: N - Limited availability on platforms. USN focus. Air defense centric in present employment.
- GCCS-M: Y/N - Available, however, attractive features are not widely employed or available to all users. SA flagged material cannot be pushed across the domain.
- RSS: Y - Designed to provide pertinent information to the necessary audience.
- CAS: N - Archival system. Not timely.
- MS-Chat: Y - Real time information sharing.

Customer Satisfaction: Overall favorable assessment by user community.

- COP: Y - Satisfies the air defense syndicate desires.
- GCCS-M: N- Difficult to use, operator workload intensive, requires specialized training.
- RSS: Y - Easy to use.

- CAS: N - Operator intensive to manage and locate files.
- MS-Chat: Y - Satisfies user's needs.

Performance refers to the potential to satisfy the desired goal *in any respect*.

- All systems appear to perform their intended functions adequately.

Flexibility scores the ability of the tool to be adapted to other warfare demands and not be limited to satisfying only the problem for which it was designed.

- COP: N - Primarily focused on air defense domain.
- GCCS-M: N - Primarily focused on maritime domain.
- RSS: Y - Adaptable across any warfare area or host system.
- CAS: Y - Capable of archiving and displaying data for any warfare domain.
- MS-Chat: Y - User group and content defined utility.

Process Integration measures the tool's ability to be introduced into the workflow process without adding to the overall process complexity.

- COP: N - Configuration managed and not easily integrated.
- GCCS-M: N - Configuration managed and not easily integrated.
- RSS: Y - Easily integrated across host systems with low workflow overhead.
- CAS: N - Difficult to reconfigure basic architecture.
- MS-Chat: Easily integrated into workflow process but requires continuous monitoring by user members.

Persistence refers to sustainability of the information flow system. In general, the less 'energy' that each user requires to keep the system running and relevant, the better the system satisfies these criteria.

- Most systems are sustained by auto-data feeds with exception of MS-Chat which requires interaction by all users.

Reduced Operator Interaction measures the overall overhead to maintain and feed the information system weighted on the system owner vice user.

- RSS requires the least system owner interaction to manipulate and maintain the information data stream.

Coalition/OGA refers to the availability of the system to non-USN partner users.

- RSS can be utilized by any designated participant with internet protocol access. Depending on the security enclave for the information feed, this can be SIPRNET, CENTRIX, or unclassified IP network.
- Extensible refers to the ability of new participants joining the information service. Exportable addresses the ability for an new invited user to obtain the system software and join the information service.
- RSS and MS-Chat are the only tool that possess these attributes.

Appendix C

Filter 2

FILTER 2

		RSS		CAS		MS Chat	
	Weight	Team Score	Total	Team Score	Total	Team Score	Total
Situational Awareness	10	10	100	4	40	9	90
Customer Satisfaction	10	10	100	3	30	8	80
Performance	8	9	72	6	48	9	72
Flexibility	7	10	70	7	49	5	35
Process Integration	9	9	81	3	27	6	54
Content Control	9	10	90	10	90	6	54
Bandwidth	6	10	60	3	18	5	30
Persistence	8	9	72	9	72	5	40
Reduced Operator Interaction	7	8	56	3	21	4	28
Total			701		395		483

This filter evaluates the same attributes as the first screen except Coalition/OGA, Extensibility, and Exportability factors were not considered discriminators across the three solutions. The weights and team scores were determined by the consultants based upon the factors' level of importance as discussed during user interviews.